No. of Printed Pages : 3 **MSTL-013(Set-I)**

M. SC. (APPLIED STATISTICS)

(MSCAST)

Term-End Practical Examination

June, 2025

MSTL-013(Set-I) : STATISTICAL COMPUTING USING R-III

Time : $2\frac{1}{2}$ Hours *Maximum Marks : 50*

Note : *(i) Attempt any **two** questions.*

(ii) Solve the questions using R-software and create a script file.

(iii) Mention necessary steps, hypotheses, interpretation, etc.

(iv) Symbols have their usual meanings.

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1. Using R, generate the population for size 100 for both the study variable y (monthly electricity consumption) and the auxiliary variable x (house size in square metres). Select a sample of size 25 using Simple Random Sampling Without Replacement

(SRSWOR), compute the ratio estimator, estimate the MSE, and compare the efficiency of the ratio estimator to the estimator obtained by SRSWOR using R. 25

2. (a) The observations of a random sample of size 10 from a distribution which is continuous and symmetric about its median are given as follows :

20.2, 24.1, 21.3, 17.2, 19.8, 16.5, 21.8, 18.7, 17.1, 19.9

Write R code for Wilcoxon test, to test the hypothesis that the sample is taken from a population having median greater than 18 at 5% level of significance.

10

(b) Draw 1000 samples from an exponential distribution with rate parameter $\lambda = 1$ using the metropolis algorithm. Use a normal proposal distribution cantered at the current state with a standard deviation of 1. Visualise the results with a histogram.

Compare the histogram to the exponential density curve. 15

3. (a) Given the vector $X = \begin{bmatrix} 2 \\ 3 \end{bmatrix}$ and a matrix $A = \begin{bmatrix} -3 & 5 \\ 4 & -2 \end{bmatrix}$. Compute the quadratic form $Q(x) = X^T AX$ in R. 10

(b) Write R code to compute the spectral decomposition for the given matrix : 15

$$D = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 1 & 1 & 2 \end{bmatrix}$$

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